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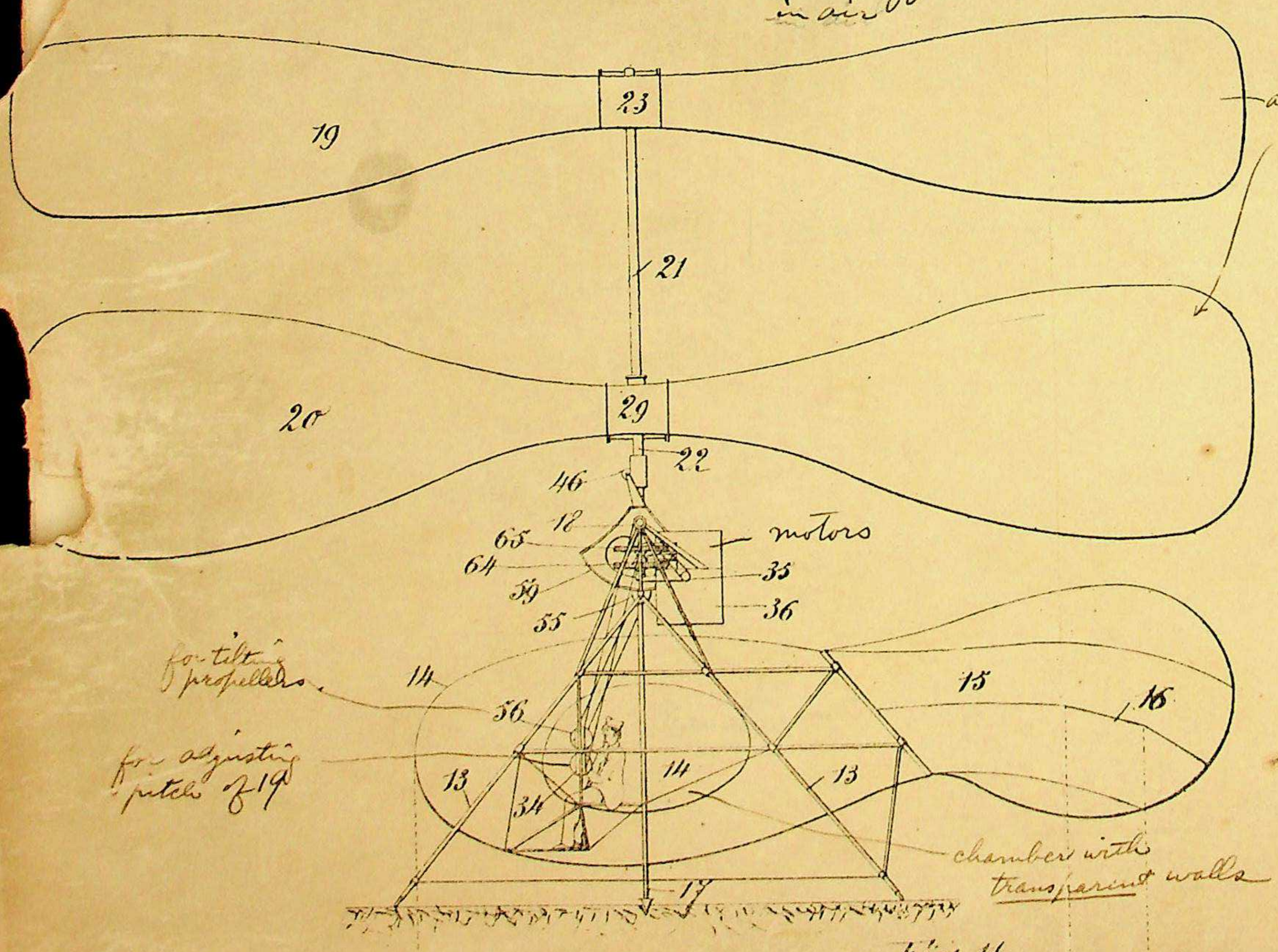
Fig. 2.

Ratchet connection between motors + propellers. Two motors, one alone sufficient to maintain apparatus in air



adjustable pitch

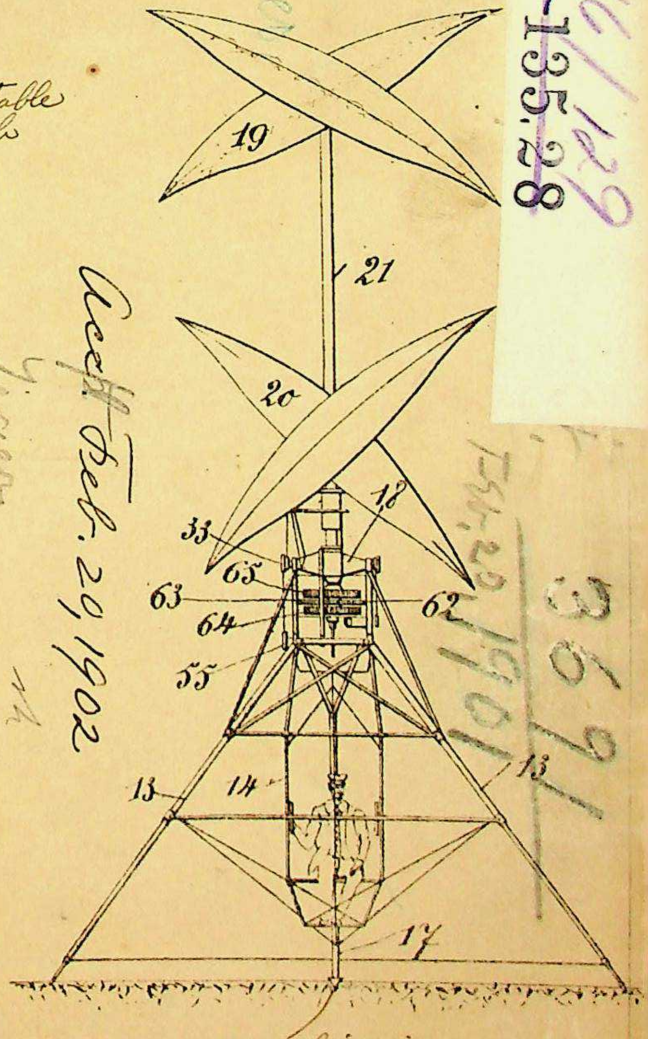
motors

for tilting propellers

for adjusting pitch of 19

chamber with transparent walls

Fig. 1



hydraulic piston to deaden shock

Acct Feb. 20, 1902

Ziger

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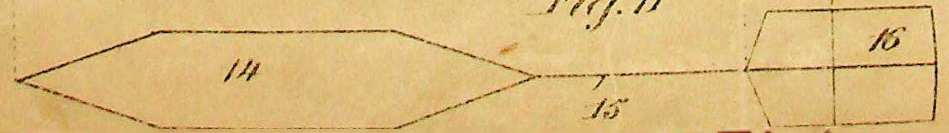
5 pages

Fig. 11



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Nº 3691 A.D. 1901

Date of Application, 20th Feb., 1901

Complete Specification Left, 20th Nov., 1901—Accepted, 20th Feb., 1902

PROVISIONAL SPECIFICATION.

"Improvements in Flying Apparatus"

I, Maurice Léger, Engineer, of Monaco, in the Princedom of Monaco, do hereby declare the nature of this invention to be as follows:

The present invention relates to a flying apparatus heavier than air, which is caused to rise and can be managed by the rotation of two screw propellers revolving in opposite directions and taking their rotative re-actions one upon the other. The wings of the said propellers can be inclined at will in order to obtain greater or less power of ascension and proportionate speed in rising and descending, or to obtain from either of the screw propellers greater or less rotative reaction for the purpose of turning the apparatus in one direction or the other without using the rudder. The axes of rotation of the said screw propellers can be inclined in the direction of the horizontal to be obtained, which allows of the translating movement of the apparatus.

The gear for operating the wings of the propellers may rotate on the supports of the latter by means of pulleys and steel bands and the gear of the upper articulated part of the apparatus may be operated by similar means for the purpose of inclining the said part with the propellers on it when desired.

Dated this 20th day of February, 1901.

HERBERT HADDAN & Co.
Agents to Applicant

COMPLETE SPECIFICATION.

Improvements in Flying Apparatus.

I, Maurice Léger, Engineer, of Monaco, in the Princedom of Monaco, do hereby declare the nature of my invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention relates to a flying apparatus heavier than the air and driven by means of screw propellers.

In the annexed drawings,

Fig. 1 is a front view of the apparatus.

Fig. 2 a side elevation.

Fig. 3 is a vertical section of the mechanism for operating the screws and inclining their shafts.

Fig. 4 is a vertical section in a plane perpendicular to that of Fig. 3.

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Fig. 3^a is a vertical longitudinal section of the arrangement for fixing the screws on their respective shafts.

Fig. 4^a is a vertical transverse section of Fig. 3^a

Figs. 5 6 and 7 are plan views of details of the apparatus

Fig. 8 shows an elevation and plan of the operating toothed wheels.

Figs. 9 and 10 show horizontal sections on lines IX—IX and X—X of Fig. 4 on an enlarged scale.

Fig. 11 is a plan view of the rudder.

Fig. 12 represents diagrammatically the construction of one blade of the screw propeller.

The apparatus comprises a light frame 13 of metal tubing in the interior of which is arranged a chamber 14 with transparent walls for the aeronaut. At the back of the said chamber the rudder 15 is obliquely pivoted said rudder being provided with wings 16 perpendicular to its plane spreading out progressively as desired and having for their object during their forward movement to flap in the air and thus to raise the rear part of the apparatus: the said wings are pivoted to the rudder and their free ends are supported by means of steel-wires which are pulled or released from the interior of the chamber in order to more or less open or shut the various wings.

In case of descent owing to accident or complete stoppage of the motors whether voluntary or not, a hydraulic piston 17 is arranged so as to touch the ground in order to progressively deaden the shock for a suitable length, corresponding to the speed of the descent which practically does not exceed 10 metres a second. Said piston may also be pivoted in order to receive the shock in an inclined direction.

The frame 13 carries at its upper part a cross bar 18 supporting the top of the apparatus which comprises two screw propellers 19 and 20 respectively mounted on two concentric tubes or shafts 21 and 22. The shaft 21 carries at its upper part a tubular cross head 23 the extremities of which are cylindrical like those of the blades of the screw propeller with which they are connected by means of circular slides 24 into which penetrate suitably shaped mountings fixed to the extremities of the parts which are to be connected with each other.

On the head 23 is mounted a shaft 25 carrying at its centre and at the extremities grooved pulleys 26, 27 and 28. In the grooves of each of these pulleys steel wires are rolled in opposite directions those of the pulleys 27 and 28 having their ends fixed, one to one side of the corresponding blade 19 and the other to the other side, the wires on the said pulleys 27 and 28 being rolled in a reverse direction in order to communicate the rotations to the blades of the screw propeller. The tube or shaft 22 is also provided at its upper part with a tubular head 29 on the ends of which are mounted the two blades of the screw propeller 20 as in the preceding case.

The head 29 carries two shafts 30 forming a straight line and each carrying pulleys 31 and 32 on which double steel-wires are rolled, those of the pulleys 32 being fixed to the blades of the screw propeller 20 in a similar manner to those of the pulleys 27 and 28 of the propeller 19.

On the axle of the cross bar 18 is loosely mounted a double pulley 33 connected on one hand with an operating pulley 34 by means of a double steel wire and on the other hand with a pulley 35 mounted on the frame of the motors 36 as shown in Fig. 2, the pulley 35 is connected with a pulley 37 shown in Fig. 3 the axle of which carries another pulley 38 arranged in the centre of the apparatus at the lower end of the tubular shaft 21 and on which two steel wires are rolled, fixed to the ends of a slide 39 connected by means of a roller 40 with a rod 41 connected by a steel wire with the beforementioned pulley 26 the said wire being rolled also on a guide pulley 42. The arrangement of the roller 40 allows the part of the transmission mechanism arranged above same to turn with the shaft 21 without exercising torsion on the slide 39 which is only movable in its plane. The roller 40 is guided in its axial displacement by a tube 43 concentric to the shaft 21 and connected with the latter as shown in Figs. 3 and 4. The pulley 42 is mounted in a bracket 44 fixed to the interior of the shaft 21 as shown in Fig. 10.

Another operating pulley similar to 34 and like the latter placed within reach of the aeronaut is connected by means of a double steel-wire with a pulley 45 loosely mounted on the axle of the cross bar 18 and connected with a pulley 46 the shaft of which carries a pulley 47 on which is rolled a double steel wire attached to the ends of a slide 48 fixed on a tube 49 concentric to the shaft 22 the said slide 48 being formed of two crowns connected with each other by means of stays and mounted on balls on a concentric tube 50, the said latter tube carries guide blocks 51 (Fig. 9) which are movable on the rectilinear guides 52 fixed to the shaft 22. The tube 50 carries two interior brackets 53 symmetrically attached to the interior of the tube 50 and their ends are respectively attached to steel wires rolled up on guide pulleys 54 (Fig. 4) and on pulleys 31.

A pulley 55 connected by means of steel wires with an operating pulley 56 is mounted on the same shaft 57 as a pulley 58 carrying steel wires which are respectively attached at their ends to the two sides of a sector 59 formed in one piece with the cross bar 18.

The motors 36 which are for instance two in number operate pinions 60 and 61 the axles of which carry toothed wheels 62 and 63 respectively which gear together in order to render the transmitted movements uniform and for the purpose of allowing movement to be transmitted to the two propellers when only one motor is working; said pinions 60 and 61 also gear respectively with the toothed wheels 64 and 65 arranged one above the other and fixed one to the tubular shaft 21 and the other to the shaft 22 as shown in Fig. 8.

The two motors are of the same power and perfectly independent of each other; one alone is sufficient to maintain the apparatus in the air and they communicate their movement to the wheel train by means of ratchet wheels allowing the propellers to revolve without operating the motors in such a manner that if one of the motors is accidentally stopped the other continues to work and to engage the propellers, the aeronaut thus having time to chose a suitable place for his descent which he can effect as slowly as desired.

The blades of the propellers are of a special construction; they are preferably made of sheet or plate aluminium, the part nearest the axle is cylindrical as mentioned above whilst the part furthest therefrom simply forms a curved line; the various cross sections present a succession of intermediate forms between the circle and the extreme curve as shown in the lower part of Fig. 12.

Each blade consequently consists of two curved surfaces of sheet aluminium which are connected with each other by means of iron or steel plates forming transverse and longitudinal stays; the whole is connected together by means of rivets.

In normal working the motors drive the pinions 60 and 61, wheels 64 and 65, the tubular shafts 21 and 22 and consequently the two propellers 19 and 20 which revolve in opposite directions. In the apparatus shown in the drawing the two propellers operate in the same zone because they have the same diameter and the same axis; they would operate in concentric zones if they had different diameters and the same axis, and if the larger one had a form resembling that of two blades fixed to the ends of a rod perpendicular to the shaft, the length of the said rod between the blades corresponding to the diameter of the other propeller; finally the propellers would operate in quite different zones if they had different axes and they could both have more than two blades.

According to whether it is desired to increase or reduce the ascensional speed the power of the motors or the inclination of the blades of the propellers are varied as will be explained below. In order to work the blades of the propeller 19 the aeronaut operates the pulley 34 thus communicating the movement to the pulleys 33, 35, 37, 38 and according to the direction of rotation of the said pulley 34 the rod 39—41 is raised or lowered, at the same time causing the pulley 26, shaft 25 and pulleys 27 and 28 to revolve by means of the steel wires to which they are attached, the wires rolled on the pulleys causing the two blades of the propeller 19 in the slides 24 to rotate in opposite directions and they can also be inclined as desired.

In order to vary the inclination of the blades of the propeller 20 the aeronaut communicates rotary motion to the pulley 45 by means of the operating pulley which is arranged within the reach of his hand, the said pulley 45 communicates the same motion to the pulleys 46 and 47; the wire rolled on the pulley 47 and attached at its ends to the ends of the slide 48, is rolled up in one direction and unrolled in another direction, in such a manner that the slide 48 rises or descends at the same time engaging in this motion the tubes 49 and 50 and consequently also the brackets 53 fixed on the tube 50; the said brackets act on the steel wires to which they are attached, the said wires thus causing the pulleys 31 and the shafts 30, 30 and pulleys 32, 32 to revolve; the wires rolled up on the pulleys 32 and attached to the cylindrical edge of the blade 20 transmit the rotary motion to the said blade which is inclined in the one or other direction.

As the brackets 53, 53 are symetrically arranged with respect to the centre of the tube 50 the rotary motions transmitted to the blades 20, 20 are equal and in opposite directions.

The blocks 51 slide along the guides 52 in such a manner as to enable the tube 50 to revolve with the tubular shaft 22 in the interior of the tube 49 and to follow the rectilinear movements of the latter.

In order to produce a horizontal displacement the aeronaut inclines the axis of rotation of the propellers in the forward direction.

For this purpose he operates the pulley 56 in order to cause the pulley 55, shaft 57 and pulley 58 to revolve, the latter operating one of the double steel wires rolled up on same.

Under the rotary action of the pulley 58 the sector 59 revolves on the cross bar 18 and engages the shafts 21 and 22 which respectively carry the screws 19 and 20. The motors 36 oscillate with the sector 59 to which they are fixed; consequently whatever the inclination of the shafts 21 and 22 of the propeller, the motors 36 operate the pinions 60 and 61 (Fig. 8) and also the wheels 64 and 65 respectively mounted on the shafts 21 and 22 and the screws 19 and 20 are carried with the rotary motion.

By means of this apparatus the following movements can be performed in the air: firstly to ascend and descend vertically and obliquely; secondly to turn in the one or other direction while stationary or during forward movement by means of sufficiently turning on their axes the blades of one of the propellers in order that its reaction may differ from that of the other propeller; thirdly, to execute a horizontal or oblique displacement by means of inclining the axis of rotation of the propellers forwards in a suitable direction; fourthly, to remain stationary at a fixed point in space, and in general to perform any suitable movement in any direction whatever the direction of the wind.

It should be noticed that all transmission pulleys are provided with two grooves each of which receives a steel wire in order that by means of one of these wires the rotation can be communicated in one direction whilst by means of the other wire the rotation can be communicated in the other direction.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In a flying apparatus heavier than the air, the arrangement at the top of the apparatus in two horizontal and parallel planes of two propellers the vertical tubular shafts 21 and 22 of which are concentric and connected with the motor, one directly by means of a pair of gear wheels and the other by means of two pairs of gear wheels.

2. In a flying apparatus heavier than the air the arrangement at the top of the apparatus of two propellers, the vertical tubular shafts 21 and 22 of which are arranged in a cross bar 18 carrying the motor and fixed to the frame 13 by means of two pivots, the axle of which is horizontal, the said cross bar 18 carying also a sector 59 concentric to the horizontal axle of the said cross bar 18 and connected with a pulley 58 by means of two steel wires fixed with their ends to the said pulley and sector, the said pulley 58 being fixed by means of steel wires to an operative pulley arranged within reach of the aeronaut.

3. In a flying apparatus heavier than the air the arrangement at the top of the apparatus of two propellers, each of which consists of two blades formed of two curved surfaces of alluminium plate connected with each other by means of iron or steel plates forming transverse and longitudinal stays; the furthermost part of the axle of each blade being a simple curved line and the nearest part of the axle being cylindrical.

4. In a flying apparatus heavier than the air the arrangement at the top of the apparatus of two propellers consisting of two or several blades, the furthermost part of which from the axle is a simple curved line whilst the nearest part is cylindrical, the said blades being suitably pivoted, by means of the said cylindrical parts to the cylindrical cross head 23 and 29 of the same diameter and fixed to the upper part of each shaft of the corresponding propeller, whilst on the said cross heads are arranged either above or below and parallel to the latter shafts 25 and 30 operated by means of pulleys and steel wires and carrying on their free ends pulleys 27 and 32 connected by means of steel wires with the cylindrical parts of the said blades.

5. In a flying apparatus heavier than the air the arrangement at the top of the apparatus of two propellers consisting of two or several blades, the furthermost part of which from the axle is a simple curved line whilst the nearest part is cylindrical, the said cylindrical parts of the blades of the propellers being pivoted to the cylindrical cross heads 23 and 29 of the same diameter fixed to the corresponding shafts 21 and 22 in the shape of concentric tubes arranged with their lower end in a cross bar 18 carrying the motor and connected with the frame 13 of the apparatus by means of two pivots with horizontal axes, each of the said cross heads 23 and 29 carrying either above or below and parallel to its axle a shaft 25, or 30, extending along the said corresponding cross head and carrying at its free ends grooved pulleys on each of which are rolled in opposite directions and fixed at their respective ends two steel wires rolling up automatically and fixed on the other hand on the said cylindrical parts of the said blades, the said shaft 25 of the upper propeller 19 being broken in its centre and carrying a pulley 26 connected by means of two steel wires with a guide pulley 42 arranged in the interior of the said shaft 21 of the upper propeller and guiding in combination with a bracket 44 a rod 41 fixed on the one hand to the said steel wire of the said pulley 26 and on the other hand by means of its lower end and a roller 40 to a slide 39 connected with an operative pulley 34 within reach of the aeronaut by means of steel wires and transmission pulleys partly arranged on one of the ends of one of the pivots of the said cross bar 18 carrying the two concentric shafts of the propellers, the said shaft 30 of the lower propeller being in two parts and carrying on its ends two pulleys 31 with double grooves on each of which is rolled up in opposite directions and fixed by means of its lower ends, a steel wire passing on a guide pulley 54 the axle of which is externally fixed to the said hollow shaft 22 of the said lower propeller, each of these wires being fixed by means of one of its branches to a tube 43 concentric with and axially guided on the said propeller shaft 22, and circularly by an exterior tube 49 which is axially guided by and connected by means of steel wires with a pulley 47 the axle of which arranged in a sector formed in one with the cross bar 18 supporting the said propeller shafts is connected with an operative pulley within the reach of the aeronaut by means of steel wires and guide pulley partly arranged on one of the pivots of the said cross bar 18.

6. In a flying apparatus heavier than air consisting of two propellers arranged on two vertical and concentric shafts above the frame of the apparatus, the arrangement whether in the prolongation of the said shafts or not, of a vertical hydraulic piston 17 adapted to be inclined in any direction.

Dated this 20th. day of November 1901

HERBERT HADDAN & Co.
Agents to Applicant
18 Buckingham Street. Strand, W.C., London.

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